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AUTHOR	Dwyer, Francis M., Jr.
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ABSTRACT

Several studies were conducted which investigated certain variables associated with visualized instruction. In these studies an evaluation was made of abstract line drawings, detailed shaded drawings, and photographs. The material was presented by tape recording, television, or a programed format and supplemented by one of the aids. Posttesting was done to evaluate the relative merits of each visual aid under each method of presentation with reference to a drawing test, an identification test, a terminology test, a comprehension test, and a total criterial test. The students were asked which visual aid they preferred and an analysis was performed to see if there was a correlation between preference and effectiveness. An additional study was performed adding a model to the previously mentioned visual aids for evaluation. The results of these studies form the basis of a number of generalizations which may be helpful in guiding the production and use of visual illustrations used for instructional purposes. A reference list is appended. (JY)

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Adapting Varied Visual Illustrations for Optimum Teaching and Learning*

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Francis M. Dwyer, Jr.

University Division of Instructional Services
The Pennsylvania State University

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The last decade has witnessed a tremendous increase in the use of visual media for instructional purposes. Unfortunately the research which should be governing this usage is virtually nonexistent. There is at the present time very little experimental evidence indicating which types of visual materials are most effective in promoting student achievement of different learning objectives. Guidelines need to be established which will enable an instructor or an illustrator to predict which type of visualization will be most effective in promoting student achievement of different learning objectives.

Current development of visual material assumes that they facilitate instruction and thereby enhance student learning. Judging from the random use of visuals it appears that the prevalent feeling is that one type of visual is as good as another in facilitating students' achievement of the many different types of educational objectives. The evailability of many types of visual materials is increasing the instructors' opportunity for making choices, but guidelines for making the choice are not available.

Justification for the use of the various types of visual illustrations for instructional purposes should be based on their distinctive contributions to specific types of learning. Unless experimental evidence is available as to how the learners will react to variations in the amount and kinds of stimuli contained within the various types of visuals, instructors and illustrators may be hindering rather than facilitating the learning process. Consequently, it seems evident that instructional media which depend primarily upon the visual channel to transmit their message would profit measurable from a program of systematic evaluation.

The purpose of this article is to review several studies which investigated several variables associated with visualized instruction. The following are some of the questions which provided the general orientation for the several studies.

1. Will the use of visual illustrations designed to complement instruction improve student achievement?
2. Are all types of visuals equally effective in facilitating student achievement of all types of learning objectives?
3. Is color in visuals an important instructional variable in facilitating achievement of specific objectives?

In an attempt to answer these questions a 2000-word instructional unit on the human heart was developed. The script described the heart, its parts, and the internal processes which occur during the systolic and diastolic phases. This content was selected because it permitted the evaluation of several learning objectives. In each study, students received the same instructional unit and were evauated by the same criterial tests. This procedure was followed in order to permit comparisons among the several studies.

To measure student achievement of different objectives four criterial tests were developed. Scores achieved on the four individual criterial tests were combined into a 78-item total criterial test. The objectives of the criterial tests were as follows: (a) drawing test-to evaluate knowledge of specific locations of the various patterns, structures and positions of the parts of the heart; (b) identification test- to measure the students ability to identify numbered parts of the heart from information received in the instruction; (c) terminology test-to evaluate knowledge of referents for specific symbols; (d) comprehension test-to measure student understanding of the heart and its internal processes; and (e) the total cirterial test-to measure the total understanding of the concepts presented.

For the initial study (Dwyer, 1967) four slide sequences were designed, each containing 39 slides. Each slide was designed to illustrate a specific item of information described in the heart script. Each sequence displayed relatively the same information, the slides differing only in the amount of detail they contained. For this first study the heart script was audiotaped. The oral and visual presentations were synchronized so that the

appropriate visuals appeared simultaneously with the oral instruction they were designed to complement. In this study college students viewed their respective treatments for equal amounts of time. Students in treatment I, the control group, received the oral presentation without visuals of the heart; students in treatment II received abstract line drawings to complement the oral instruction. Students in treatment III viewed detailed, shaded drawings and students in treatment IV viewed photographs of an actual heart specimen.

Results indicated that the abstract line drawing presentation should be used to complement oral instruction designed to facilitate student achievement of educational objectives similar to those measured by the drawing, identification, and total criterial tests. The oral presentation without visuals should be used to facilitate student achievement of educational objectives similar to those measured by the terminology and comprehension tests.

In a different study (Dwyer, 1968a) the same four instructional treatments were videotaped and presented to students via conventional 22" television monitors. The results of this study indicated that treatment I, the oral presentation without visuals, was as effective as the visually complemented treatments on four of the five criterial tests. The exception was the drawing test in which the abstract line presentation was found to be significantly more effective than the oral presentation in facilitating student achievement.

Several explanations may be advanced to explain the results obtained in this study: (a) since college students are usually high in verbal and conceptual ability, it may be that they are in a highly favorable position in terms of being able to learn from oral instruction; (b) the realistic detail contained within the visual illustrations may have had the next effect of distracting student attention from the essential learning cues in the visuals, thereby interferring with rather than facilitating achievement, and (c) since students in each treatment viewed their

respective televised presentation for equal amounts of time, those students who viewed the more realistic types of visuals may not have had sufficient time to study and comprehend adequately the additional information contained in the visual illustrations presented to them.

In a third study involving college students (Dwyer, 1967b) the heart script was put in a programed format. Each programed booklet contained 37 paragraph type frames on 5 1/2 x 8 1/2 inch sheets. 2 1/2 x 3 1/2 inch illustrations were made from slides used in the two studies previous mentioned. These illustrations were placed on the programed frames containing the information they were designed to illustrate. In this study students were permitted to view their instructional treatments for as long as they felt necessary to comprehend the material being presented.

Results indicated that the realistic photographic presentation, treatment IV, should be used to complement programed instruction designed to facilitate student achievement of educational objectives similar to those measured by the drawing, identification, the total criterial tests. The programed presentation without visuals should be used to facilitate student achievement of educational objectives similar to those measured by the terminology and comprehension tests. These results might be explained by the fact that the photographic illustrations contained more realistic detail than did the other types of visuals. Since the instruction was presented via programed booklets, and since the students were permitted to spend as much time as they felt necessary in reacting with the realistic detail in the photographs, they could absorb as much information as they felt was necessary to complete their understanding of the material. Since the drawing and the line presentations possessed lesser amounts of realistic detail, students were limited in the amount of information they could extract from them regardless of the lenght of time that they were available for study.

It is generally assumed that the visual media can be used to:

(a) focus attention on essential learning characteristics, (b) increase interest and motivation, and (c) illustrate oral and verbal statements which otherwise would be ambiguous. If these assumptions are correct, it seems reasonable to expect that students should be able to give some indication as to which types of visual illustrations are most helpful in improving their learning. If it can be established that students can accurately identify the instructional value of specific types of visual illustrations, it might then be possible to establish guidelines predicting the instructional effectiveness of various types of visual illustrations.

In an attempt (Dwyer, 1969) to determine whether student perceptions of the instructional value of different types of visual illustrations are valid, a Visual Illustration Questionnaire was developed. This questionnaire was administered to students who participated in the programed study previously mentioned. The questionnaire consisted of five questions and contained a sample of each type of visual viewed by students in the four treatments.

An analysis of student responses to the questionnaire revealed that, in general, students in the four treatments: (a) confirmed that the visuals they received in their instructional booklets presented visually the same information that was being presented verbally; (b) indicated that the use of visual illustrations to complement instructional units was desirable because it facilitated learning and improved understanding of the subject matter; and (c) felt that the programed unit complemented by means of the detailed, shaded drawings would be most effective in improving their achievement on the different criterial measures.

In comparing the students' perceptions with the experimental data resulting from the criterial tests, it was found that their opinion that the use of illustrations to complement instruction would improve their achievement was confirmed on the drawing, identification, and total criterial tests. However, their

perceptions were not justified on the terminology and comprehension tests because on these tests the achievement of students who received the programed treatment without visuals was equal to the achievement of those students receiving the visually complemented treatments. The students in the four treatment groups felt that the detailed, shaded drawing presentation, treatment III, would be most effective in improving their achievement. However, this was not found to be the case - the realistic photographs, treatment IV, were found to be most effective. These results are in agreement with previous findings (Elliott, 1949; Twyford, 1951; Macomber and Siegel, 1957) which suggest that student attitudes towards instructional media are not a valid indication of their instructional value since only small relationships exist between their approval of the medium from which they receive their instruction and their level of achievement.

A more comprehensive approach to the evaluation of the effectiveness of various types of visual illustrations involved the production of five additional visualized presentations: the abstract line drawing (cclor), the detailed, sheded drawing (color), the heart model (black and white), the heart model (color), and realistic photographs of an actual heart specimen (color). In this study (Dwyer, 1968b) the content material was presented in programed format. 2 1/2 x 3 1/2 inch photographs were made from slides designed to complement the nine instructional treatments. These illustrations were placed on the programed frames containing the information they were designed to illustrate.

The results of this study indicate that in terms of economy of production and instructional effectivness: (a) the abstract line presentation (black and white) whould be used to promote student achievement on the drawing test; (b) the programed presentation without visuals should be used to promote student achievement of those objectives measured by the terminology and comprehension tests, and (c) the heart model presentation (color) should be used to promote student achievement of those objectives

measured by the identification and total criterial tests.

An explanation may be advanced for the failure of the visually complemented presentations to facilitate achievement on the terminology and comprehension tests. It may be that the type of achievement measured by these two criterial tests did not require students to utilize the information contained in the more realistic illustrations.

The effectiveness of the colored version of the heart model presentation may be explained by the fact that the realistic detail in the visuals was accentuated by color. Consequently, students were better able to make the appropriate discriminations and obtain the necessary information required to achieve on these tests.

A number of important generalizations can be developed from the cited studies which may be helpful in guiding the production and the use of visual illustrations used for instructional purposes.

1. The use of visuals to complement instruction does not automatically improve student achievement.
2. Different visuals differ in the effectiveness with which they promote achievement of learning objectives.
3. The effectiveness of a particular type of visual in promoting achievement of a specific objective depends on the amount of time students are permitted to view the visual.
4. For specific objectives the addition of color in certain types of visuals appears to be an important instructional variable in improving student achievement.
5. Student perceptions of the value of different types of visual illustrations are not valid assessments of their instructional effectiveness.
6. Visual illustrations must be appropriately structured to maximize achievement of specific learning objectives.

In general, it seems that some visuals are more effective than others in facilitating student achievement of specific educational objectives. This seems to imply that the type of visual used in a specific instructional situation should be determined by the particular type of objective to be achieved. Consequently, an instructor preparing a lesson would have to define his objectives behaviorally and then select the appropriate visuals, i.e., those found to promote student achievement of those specific objectives most effectively.

It is obvious that many aspects related to the design and use of visual illustrations for instructional purposes have yet to be investigated. It is also clear that visual learning is not a self-executing process which will be facilitated by the arbitrary use of visuals. Visual learning is a process which has to be made to work, and to do this we have to understand it thoroughly. Guidelines need to be developed for the use of visuals that not only will account for the varying degrees of effectiveness with which different types of visuals facilitate achievement of different learning objectives, but also will take into consideration those physiological factors such as I.Q., sex, and age that may be associated with optimum visual learning. Until these factors are understood and organized in some manageable fashion, the haphazard production and ineffectual use of visual materials for instructional purposes, currently so prevalent, will continue.

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